

## Lesson 7:

### Biology Conclusion: Summarizing Learning



**Main Lesson Concept:** The biological energy flow identifies the relationships among producers, consumers, and decomposers in an ecosystem that are important for human survival.



**Scientific Question:** How is the flow of energy important for human survival?

Objectives		Standards
<ul style="list-style-type: none"> <li>Students will draw and explain concept maps that show how the members of the food web interact with many different systems to support human habitability.</li> <li>Students will write a report of their findings explaining how all astronomical, atmospheric, geological, and biological features work together as a system to support human habitability and how this balance can be maintained.</li> </ul>		<p><b>Partially meets:</b> NSES: C (5-8) #4.2 NSES: C (5-8) #4.3</p> <p><b>Addresses:</b> 2061 4B (6-8) #2 2061 11A (3-5) #1 2061 11A (3-5) #2 2061 11A (6-8) #2 2061 11A (6-8) #3 NSES C (5-8) #1.5</p>
Assessment	Abstract of Lesson	
Concept maps and report of findings.	Students review the characteristics of systems, the planetary temperature system, human body system, and the connections among the geological, atmospheric, and astronomical characteristics that support the human body system. They then draw concept maps that show the interaction of the parts of the flow of energy with important systems that support human survival. Finally, students write a report of their findings for all four Astro-Venture units that explains how all astronomical, atmospheric, geological, and biological features work together as a system to support human habitability.	





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Prerequisite Concepts	Major Concepts
<ul style="list-style-type: none"> <li>• Humans need water, oxygen, food, gravity, a moderate temperature, and protection from poisonous gases and high levels of radiation to survive. (Astronomy Lesson 1)</li> <li>• Systems consist of many parts that usually influence each other. A system may not work as well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected. Thinking about things as systems means looking for how every part relates to other parts. Any system is usually connected to other systems. (Astronomy Lesson 7)</li> <li>• The type of star, the orbital distance of a planet, and the mass of the planet are the major components of the planetary temperature system that determine the surface temperature of the planet. (Astronomy Lessons 9 and 11)</li> <li>• A large object, such as a Jupiter-size planet, orbiting near an Earth-size planet, could disrupt the planetary temperature system. (Astronomy Lesson 12)</li> <li>• Carbon dioxide and water vapor are greenhouse gases that absorb energy radiated from Earth's surface and reradiate some of it back towards the Earth, increasing the surface temperature. (Atmosphere Lesson 3)</li> <li>• Oxygen is important to humans because it helps to generate energy in the cells from sugars. (Atmosphere Lesson 5)</li> <li>• The creation and destruction of ozone in the stratosphere protects life on Earth from harmful ultraviolet radiation. (Atmosphere Lesson 6)</li> <li>• Nitrogen can have an effect on life because of its unique properties and because of the amount of it in the atmosphere, which contributes to air pressure necessary for life functions. (Atmosphere Lesson 7)</li> <li>• Temperature and pressure are key factors that determine geologic conditions. (Geology Lesson 2)</li> <li>• Density determines whether a substance will float on another substance and thus affects the composition of the Earth's layers. A change in density can affect the movement of matter. (Geology Lesson 3)</li> <li>• The interior of the Earth is hot. The heating and cooling of the mantle results in convection cells and movement inside the Earth. (Geology Lesson 4)</li> <li>• The Earth's solid crust is composed of separate sections that constantly move on a partially molten layer of the upper mantle. Major geologic events such as volcanic eruptions result from these plate motions. (Geology Lesson 5)</li> <li>• The movement of the crust and mantle allows carbon to be cycled in and out of the atmosphere, stabilizing the surface temperature. (Geology Lesson 6)</li> <li>• The rotation of the Earth and its liquid outer core generate a magnetic field that, with the atmosphere, helps protect us from cosmic rays from exploding stars and harmful solar wind produced by our star, the Sun. (Geology Lesson 7)</li> <li>• Food provides molecules that serve as fuel and building material for all organisms. (Biology Lesson 2)</li> <li>• Plants use the energy in light to make sugars out of carbon dioxide and water. Oxygen is released in this process. (Biology Lesson 3)</li> <li>• All animals, including humans, are consumers that obtain food by eating other organisms. When organisms eat plants, their bodies break down the plant structures to produce the materials and energy they need to survive. Then they are consumed by other organisms. (Biology Lesson 4)</li> <li>• Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. (Biology Lesson 5)</li> </ul>	<ul style="list-style-type: none"> <li>• The flow of energy from the Sun to producers to consumers and to decomposers defines the major relationship between living things in an ecosystem.</li> <li>• Like all systems, ecosystems are made up of parts that influence each other and can be a part of other systems.</li> <li>• The balance of ecosystems can affect the survival of humans.</li> <li>• The Sun is the source of energy for most living things on Earth.</li> <li>• The amount of producers and consumers available is important to human survival, because humans eat both plants and animals to get energy and nutrients that provide building materials.</li> <li>• The amount of decomposers is important to human survival because decomposers break down dead producers and consumers so the nutrients can be reused in new living things.</li> <li>• Producers are the only living things that can make energy by using sunlight. Consumers rely on producers in order to obtain energy for survival.</li> <li>• Producers release oxygen into the atmosphere during the process of photosynthesis, contributing to the amount of oxygen in the atmosphere needed by humans for survival.</li> </ul>



**Suggested Timeline (45-minute periods):**

Day 1: Engage and Explore Sections

Day 2: Explain and Extend Sections

Day 3: Evaluate Section

**Materials and Equipment:**

- Chart paper for class concept maps and chart of the importance of Earth's structure to humans
- Construction paper or blank white paper for students to draw their concept maps
- Different colored pens or colored pencils (for student concept maps)
- A class set of System Concept Map and Final Astro-Venture Project
- Human Survival Transparency
- Crayons, colored pencils, or markers for final report poster (optional)

**Preparation:**

- Prepare chart to record Earth's structure and its importance to humans.
- Gather materials.
- Duplicate System Concept Map and Final Astro-Venture Project.
- Prepare overhead transparency.
- Prepare chart paper with the major concept of the lesson to post at the end of the lesson.

**Differentiation:****Accommodations**

For students who may have special needs:

- Have them report orally to the teacher to explain their concept maps. Instead of the findings report, have them create a poster illustrating all of the factors on Earth that support human habitability and changes that could affect this balance. Have them orally explain how the factors work together as a system and what they would recommend to maintain the balance of the system.

**Advanced Extensions**

For students who have mastered this concept:

- Research and report on the effects humans have on Earth's balance. Have students research different sides of one issue and stage a debate.



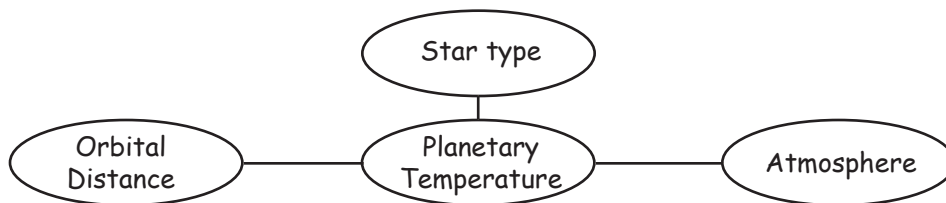
**Engage**

(approximately 25 minutes)

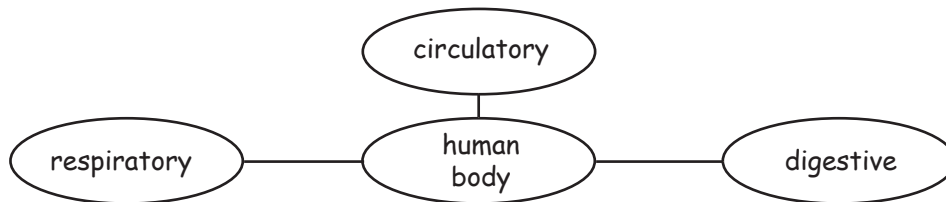
**1. Review systems, the human body systems (Astronomy Lesson 7), and the planetary temperature system (Astronomy Lessons 9, 11 and 12).**

- Question: What are the characteristics of a system?
- Answer: *Systems consist of many parts that usually influence each other. A system may not work as well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected. Thinking about things as systems means looking for how every part relates to other parts. Any system is usually connected to other systems.*
- Question: What system is largely based on the astronomical characteristics of our solar system? How is this system important to human survival?
- Answer: *The planetary temperature system is based partially on astronomical characteristics of our solar system. It is important to human survival because we need a moderate temperature that allows water to be a liquid.*
- Question: What are the parts of the planetary temperature system?
- Answer: *(As you discuss, begin to draw this as a concept map on the board.) The three main parts that determine the surface temperature of a planet are: star type, orbital distance, and the atmosphere.*

Note to Teacher: If you have completed the concept map activity with the class in Atmosphere Lesson 8 or Geology Lesson 8, simply review it at this time.



- Question: What are some of the important systems that make up the human body and help to keep us alive?
- Answer: *(As you discuss, begin to draw this as another concept map on the board.) Some of the systems that make up the human body are the respiratory system, the circulatory system, and the digestive system.*



- Question: How do these systems work?
- Answer: *They have parts that usually relate to each other or work together. If one part is missing or broken, the whole system can be affected. For example, if the star type is very hot, the planet will need to orbit at a further distance in order to maintain a temperature that is habitable.*





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## 2. Review the interaction of the atmospheric gases with the planetary temperature system and human body system (Atmosphere Lesson 8).

- Question: How do the gases in our atmosphere interact with these two systems to support human habitability?
- Answer: (Add to the concept map as students identify each of these. See the concept map on the next page as a guide of the types of connections to include) Answers should include:
  - Carbon dioxide and water vapor are greenhouse gases that absorb radiation that bounces off Earth's surface and reradiate it back to Earth, playing an important role in the surface temperature of a planet. The amount of atmosphere (including greenhouse gases) that a planet has is related to the force of gravity of that planet, which in turn depends on its mass.
  - The strength of gravity of a planet, along with its atmosphere, determines the surface pressure. Our bodies need the right amount of pressure to keep gases inside our body and to keep water a liquid on Earth's surface.
  - Nitrogen is an inert gas that makes up the bulk of our atmosphere contributing to the necessary pressure we need. Nitrogen is also a building block of proteins, which make up important parts of our bodies. Nitrogen is brought into our bodies through the digestive system.
  - Oxygen is highly reactive and reacts with sugars to give us energy. We breathe oxygen in through the respiratory system. It is circulated to the cells through the circulatory system, where it reacts with sugars that are brought in through the digestive system.
  - Ozone absorbs harmful ultraviolet radiation in the upper atmosphere and prevents much of it from reaching the Earth's surface where it can kill us. (You could connect ozone to the atmosphere part of the Planetary Temperature System. You could also connect ultraviolet radiation to the star type of the planetary temperature system, since stars put out ultraviolet light.)

## 3. Review the interaction of the Earth's structure and processes with the planetary temperature system and human body system (Geology, Lesson 8).

- Question: How do Earth's structure and processes interact with these two systems and the gases in our atmosphere to support human habitability?
- Answer: (Add to the concept map as students identify each of these. See the concept map on the next page as a guide to the types of connections to include) Answers should include:
  - The amount of carbon dioxide and water vapor in the atmosphere is an important factor in maintaining a moderate surface temperature.
  - The amount of carbon dioxide in the atmosphere is determined by the carbon cycle, in which carbon is stored in rocks. The carbon in the rocks is then broken down, returned to the Earth and eventually returned to the atmosphere by volcanic eruptions.

Note to Teacher: Some students may also point out that a part of the carbon cycle involves the carbon that makes up the bodies of living things and the food they use for energy. Producers use carbon dioxide in the atmosphere for photosynthesis. The carbon is passed along as food to consumers and eventually to decomposers. The carbon is released into the atmosphere during respiration and to the Earth during decomposition.

- The lower part of Earth's upper mantle is partially molten. Earth's lithospheric plates float upon this layer.
- Earth's lower mantle is solid, but capable of flow due to the extreme pressures inside the Earth. The extreme pressure comes from the Earth's mass, which plays a role in making the inside of the Earth hot.
- The rotation of the Earth and its liquid outer core generate a magnetic field that, with the atmosphere, helps protect us from cosmic rays from exploding stars and harmful solar wind produced by our star, the Sun.

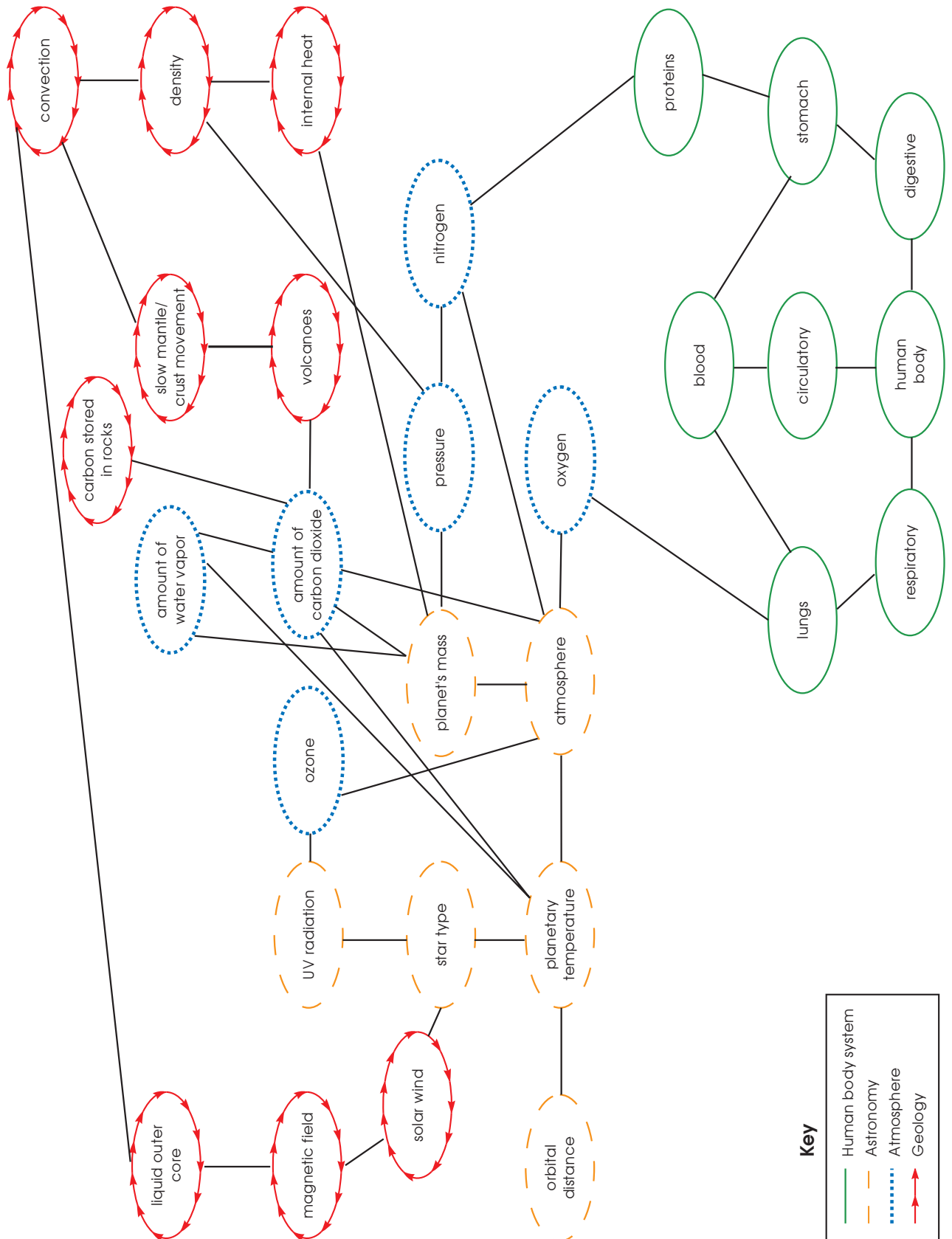
## 4. Bridge to this lesson and introduce the purpose and Scientific Question.







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Key

Human body system
Astronomy
Atmosphere
Geology





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- Say: Today, we are going to look at the flow of energy to see how it also connects to parts of the planetary temperature system and supports the human body system. The scientific question we will explore is:
- How is the flow of energy important for human survival?

#### 5. Review the flow of energy and its importance. (Biology lessons 2, 3, 4, and 5)

- Question: What are the parts of the flow of energy and how is each part important to human survival?
- Answer: (You may want to record these on a chart as seen below.)

Energy Flow Part	Importance to humans
Sun	Source of all energy
Producers	The only living things that can make food from sunlight Provide food and nutrients to consumers and decomposers Release oxygen into the atmosphere Remove carbon dioxide from atmosphere
Consumers	Provide food and nutrients to other consumers and decomposers
Decomposers	Break down dead consumers and producers so that nutrients can be reused
Nutrients	Building materials of living things (tissue, bone, etc.)

- Say: In the next activity, we'll explore how parts interact with the planetary temperature system and human body systems to support human survival.



### Explore

(approximately 20 minutes)

#### 1. Have students draw concept maps and write explanations in their Astro Journals that show how the parts of the flow of energy interact with the planetary temperature system and support human survival.

- Go over the System Concept Map directions and rubric with students. Encourage students to look for ways to connect all parts to form one large concept map.
- Students could start their concept maps in several different ways:
  - Students might start with the Sun and add each part of the flow in sequence, thinking about other connections each part has to other elements already on the concept map.
  - Students might begin with producers and think of all of the parts of the concept map that producers connect with.
  - Students might start with humans and think about where they get their food and nutrients then link backward through the flow.
  - Some students may deviate from traditional concept maps by showing cycles or flows that have sequences. As long as students are showing connections, this is fine. However, do encourage them to look for connections between different cycles and flows to emphasize the interconnectedness of all of these systems.

#### 2. The following are some suggestions and questions that may help to guide the thinking of those students who are having trouble making connections.





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- Draw and explain the flow of energy and then look for connections between each part of the flow with the existing concept map.
- Does anything in the flow of energy affect our atmosphere?
- What does eating things provide for humans?
- How are decomposers important to human survival?
- What is the source of all energy in the flow of energy?
- Does any part of the flow of energy connect to the planetary temperature system?



## Explain

(approximately 20 minutes)

### 1. Have students explain their concept maps, the connections they've made, and why to a partner.

Note to Teacher: Every student will have a different way of thinking about concepts, and concept maps can be powerful for seeing how students are making connections. They may not all be identical and some may reveal faulty logic. This is an opportunity to probe into how students are thinking about and connecting ideas and help them to correct any misunderstandings. The Sample Concept Map provided is only one possible concept map.

### 2. The following types of questions may help students to see connections they may not have made or made erroneously.

- Question: What is the source of energy in the flow of energy?  
• Answer: *The energy comes from the Sun.*
- Question: What system is the Sun a part of?  
• Answer: *The Sun is a part of the planetary temperature system (or, our solar system). On our concept map, it is the star type.*
- Question: How does the planetary temperature system connect to the flow of energy?  
• Answer: *The star type (or Sun) connects to producers because producers are the only living things that can make food from sunlight.*
- Question: How do producers affect human survival?  
• Answer: *Producers provide food for energy and nutrients (for building materials) to humans and other consumers that humans eat. Producers also take in carbon dioxide and release oxygen into the atmosphere.*
- Question: So, what connections could you make from producers?  
• Answer: *You can connect producers to nutrients, to consumers, to human's stomach or digestion system, to carbon dioxide, and to oxygen.*
- Question: How do consumers affect human survival?  
• Answer: *Consumers are a food, energy, and nutrient source for humans. The matter that makes up a human comes from other living organisms.*
- Question: So, what connections could you make from consumers?  
• Answer: *You can connect consumers to human's stomach or digestion system and to nutrients.*
- Question: How do decomposers affect human survival?  
• Answer: *Decomposers break down dead consumers and producers so that nutrients can be used again.*







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- Question: So, what connections could you make from decomposers?
- *Answer: You can connect decomposers to human body system, to nutrients, to consumers, and to producers.*
- Question: How do nutrients affect human survival? From where do we get nutrients?
- *Answer: We need nutrients for building materials to make tissues, bones, etc. We get nutrients from the food we eat.*
- Question: So, what connections could you make from nutrients?
- *Answer: You can connect nutrients to producers, to consumers, and to human's stomach or digestive system.*
- Question: What do you notice about how the flow of energy connects to the planetary temperature system and the human body system?
- *Answers may include: The flow of energy provides a connection from the planetary temperature system to the human body system. The major connection is from the Sun to the food that goes through our digestive system.*
- Question: Does the flow of energy interact with the atmosphere?
- *Answers may include: Since producers take in carbon dioxide and release oxygen during the process of photosynthesis, there is a connection with atmosphere.*



## Extend/Apply

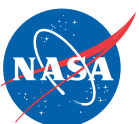
(approximately 25 minutes)

### 1. Introduce the final project that will summarize student learning from this unit.

- Go over the Final Astro-Venture Project directions and rubric for the report of findings project.

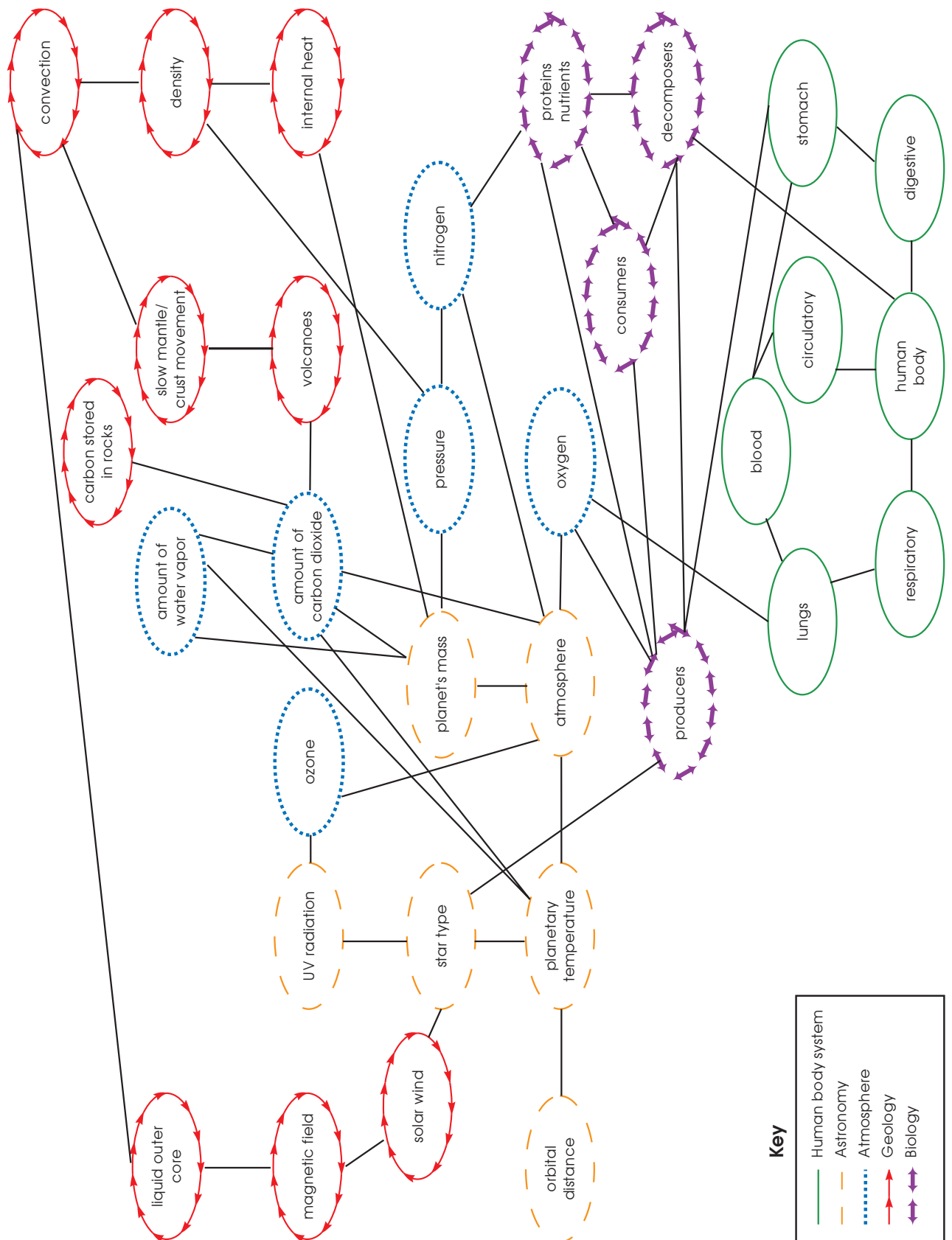
Note to Teacher: A variation or addition to the report would be to have students create a poster on their findings, changes, and recommendations and to have them present these in a poster session at a mock "World Science Foundation" conference.

- Draw students' attention to all of Earth's features that were covered in Astro-Venture and their importance to human survival. You may want to use a completed concept map that has all of these features and focus on how all features work together in a system.
- Put up the Human Survival Transparency from Biology Lesson 1. (Astronomy factors are in plain text. Atmosphere factors are italicized. Geology factors are bolded and Biology factors are underlined to differentiate them



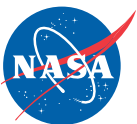


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**Key**

- Human body system (green line)
- Astronomy (orange line)
- Atmosphere (blue line)
- Geology (red line)
- Producers (purple line)
- Consumers (purple line)
- Decomposers (purple line)





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from each other.)

Humans need:	Reason:	What Factors Provide This:
Food	Gives us energy so that we can move, grow, and function. It also gives us nutrients to build and mend bones, teeth, nails, skin, hair, flesh, and organs.	<i>Nitrogen is a nutrient</i> <u>Carbon is another nutrient passed from organism to organism in the form of food</u> <u>Sunlight provides energy for producers.</u> <u>Producers turn sunlight into food that consumers and decomposers consume.</u> <u>Decomposers break down dead things to provide nutrients for other living things.</u>
Oxygen	Helps us to obtain energy from sugars.	<i>Oxygen helps us get energy from sugars</i> <u>Producers release oxygen</u>
Water	Allows nutrients to circulate through the body. Helps to regulate body temperature. The cells that make up our bodies are made mainly of water.	(related to temperature)  Water vapor is a greenhouse gas in our atmosphere
Moderate temperature (Average global temperature above 0° C and below 50° C)	Allows us to maintain an average body temperature of 98.6° F/37°C and to maintain water in a liquid state at all times.	Star type Orbital distance Planetary mass (Orbits of large planets/objects could disrupt) <i>Greenhouse gases reradiate heat</i> <b>Crust and mantle motion cycle carbon in and out of atmosphere</b>
Protection from poisonous gases and high levels of radiation	To prevent cancer, disease, and damage to the body.	<i>Ozone protects from UV</i> <i>Our atmosphere doesn't have high levels of poisonous gases</i> <b>Liquid outer core forms magnetic field that helps to protect from solar wind and space radiation</b>
Gravity	Allows our biological systems to develop and function normally. Holds the atmosphere on the Earth so it doesn't escape into space.	Planetary mass <i>Nitrogen provides pressure</i>

- Brainstorm changes that could happen to Earth to upset any of these factors important to human habitability.
- Discuss possible recommendations that might be made to try to prevent these changes.

Note to Teacher: Some changes are unpreventable by humans such as the eventual change of our yellow star to a red giant star. Point this out and help students to focus on those changes that humans can prevent such as the level of chlorofluorocarbons (CFCs) or greenhouse gases in the atmosphere.

- Allow students time to work on their final projects.

Note to Teacher: You may want to allow students to finish their reports as homework. Otherwise, you may need to allow more class time for completion





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## Evaluate

(approximately 45 minutes)

1. Allow students to complete their reports.

2. Have students share their changes and recommendations with the class.

3. Discuss students' reports to ensure they have mastered the major concepts.

- Question: How do astronomical features of our solar system support human habitability?  
• Answer: *Our star type, distance from the Sun, and planetary mass all play a role in determining the surface temperature of Earth. A planet like Jupiter in a closer or less circular orbit could disrupt Earth's orbit throwing it into space or destroying it.*
- Question: How do Earth's atmospheric features support human habitability?  
• Answer: *The right amount of greenhouse gases in our atmosphere plays a role in our surface temperature. Humans need oxygen to obtain energy from sugars and to create ozone in the upper atmosphere protecting us from UV radiation. Nitrogen is an inert gas that helps (along with the other gases in our atmosphere) to provide the necessary pressure we need. Nitrogen is also a part of the proteins we need to survive.*
- Question: How does Earth's geologic structure and processes support human habitability?  
• Answer: *The movement of the Earth's crust and mantle play a role in the carbon cycle, regulating the amount of carbon dioxide in the atmosphere, which plays a role in determining the Earth's surface temperature. The Earth's liquid outer core rotates as the Earth spins forming a magnetic field that, with the atmosphere, protects humans from dangerous space radiation.*
- Question: How do other living things on Earth support human habitability?  
• Answer: *Producers are the only living things that can make food from sunlight. Producers and consumers provide food and nutrients to humans. Decomposers break down dead things so that the nutrients can be reused. All living things depend on one another for their survival.*
- Question: How do all of these features work together as a system?  
• Answer: *The parts are all connected. If you take out one part, the system would not be able to support human habitability. For example, Earth's surface temperature is determined by astronomical, atmospheric, geological, and biological factors that all work together to maintain a moderate temperature. If you took one of these factors out, Earth's temperature would change.*
- Question: What can humans do to help maintain the balance of this system?  
• Answers may include: *Humans can regulate the amount of greenhouse gases and CFCs released into the atmosphere. Humans can also work to prevent disruption to food webs.*





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**4. Collect students' Final Astro-Venture Projects and System Concept Maps, and evaluate them to ensure that they have each mastered the major concepts:**

- The flow of energy from the Sun to producers to consumers and to decomposers defines the major relationship between living things in an ecosystem.
- Like all systems, ecosystems are made up of parts that influence each other and can be part of other systems.
- The balance of ecosystems can affect the survival of humans.
- The Sun is the source of energy for most living things on Earth.
- The amount of producers and consumers available is important to human survival, because humans eat both plants and animals to get energy and nutrients that provide building materials.
- The amount of decomposers is important to human survival because decomposers break down dead producers and consumers so the nutrients can be reused in new living things.
- Producers are the only living things that can make energy by using sunlight. All consumers rely on producers in order to obtain energy for survival.
- Producers release oxygen into the atmosphere during the process of photosynthesis, contributing to the amount of oxygen in the atmosphere needed by humans for survival.

Note to Teacher: After each lesson, consider posting the main concept of the lesson some place in your classroom. As you move through the unit, you and the students can refer to the “conceptual flow” and reflect on the progression of the learning. This may be logistically difficult, but it is a powerful tool for building understanding.







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## System Concept Map

Draw a concept map that shows how the parts of the flow of energy connect to the planetary temperature system and human body system to support human survival. Use different colors for the planetary temperature system, the human body system, the atmospheric gases, geological characteristics/processes, and flow of energy.

Include the following:

- All parts of the flow of energy explored in this unit
- The planetary temperature system and its three primary components
- The human body system and important sub-systems
- The five atmospheric gases previously explored: carbon dioxide, water vapor, oxygen, ozone, nitrogen
- The Earth's geologic characteristics and processes
- An explanation of the connections you draw between the systems, the gases, Earth's geologic characteristics and processes, and why these connections are important to human survival

Your concept map will be evaluated using the following rubric:

4	<ul style="list-style-type: none"><li>• The concept map clearly and accurately shows connections between all parts of the flow of energy, the planetary temperature system, and the atmospheric gases and forms one large concept map. The description clearly and accurately describes all connections and their relevance to human survival.</li><li>• The concept map has all required parts, and the design elements (circles, color, and lines) are exceptionally clear and easy to understand.</li></ul>
3	<ul style="list-style-type: none"><li>• The concept map clearly and accurately shows connections between all parts of the flow of energy, the planetary temperature system, and the atmospheric gases but may be in two separate concept maps. The description clearly and accurately describes all connections and their relevance to human survival.</li><li>• The concept map has all required parts, and the design elements (circles, color, and lines) are clear and easy to understand.</li></ul>
2	<ul style="list-style-type: none"><li>• The concept map is not completely clear or accurate in showing connections between some of parts of the flow of energy, the planetary temperature system, and the atmospheric gases. The description is not completely clear or accurate in describing the connections and their relevance to human survival.</li><li>• The concept map has most required parts, and the design elements (circles, color, and lines) are a little difficult to read.</li></ul>
1	<ul style="list-style-type: none"><li>• The concept map is not clear or accurate in showing connections between parts of the flow of energy, the planetary temperature system, and the atmospheric gases. The description is not clear or accurate in describing the connections and their relevance to human survival.</li><li>• The concept map is missing several parts, and the design elements (circles, color, and lines) are difficult to read.</li></ul>





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## Final Astro-Venture Project

You have now explored the astronomical, atmospheric, geological, and biological conditions on Earth that support human habitability requirements. Your research was funded by the World Science Foundation, and they would like to know what your research results are so that the world can learn from it.

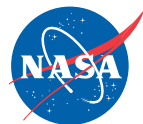
Summarize your findings in a report to the World Science Foundation. In your report make recommendations on maintaining Earth's balance to ensure that humans can survive here for many years to come. Include the following:

- A description of the astronomical features of our solar system that support human survival.
- A description of the atmospheric features of our planet that support human survival.
- A description of the geological features of our planet that support human survival.
- A description of the biological features of our planet that support human survival.
- A description of how all of these features work together as a system.
- A description of two or more changes that could upset the system, making Earth or some parts of Earth uninhabitable to humans.
- Two or more recommendations of what humans can do to help sustain the balance of the Earth system to continue to support human habitation.

Your findings report will be evaluated using the following rubric:

4	<ul style="list-style-type: none"><li>• The report clearly and accurately describes all astronomical, atmospheric, geological, and biological features that support human survival and accurately describes how these features work together as a system.</li><li>• The report includes two or more changes and two or more recommendations that are all accurately described. The report includes examples and reasoning in describing these changes and recommendations that create an exceptionally powerful and detailed persuasive argument.</li></ul>
3	<ul style="list-style-type: none"><li>• The report clearly and accurately describes all astronomical, atmospheric, geological, and biological features that support human survival and accurately describes how these features work together as a system.</li><li>• The report includes two changes and two recommendations that are all accurately described. The report makes specific references to examples and uses good reasoning in explanations used in describing these changes and recommendations.</li></ul>
2	<ul style="list-style-type: none"><li>• The report is not completely clear or accurate in describing most astronomical, atmospheric, geological, and biological features that support human survival and how these features work together as a system.</li><li>• The report includes one change and one recommendation that are not completely accurate. The report makes some specific references to examples and uses some good reasoning in explanations used in describing these changes and recommendations.</li></ul>
1	<ul style="list-style-type: none"><li>• The report is not clear or accurate in describing most astronomical, atmospheric, geological, and biological features that support human survival and how these features work together as a system.</li><li>• The report is missing several parts, makes few specific references to examples and uses little or no good reasoning in explanations used in describing these changes and recommendations.</li></ul>





# Human Survival Transparency

Humans need:	Reason:	What Factors Provide This:
<b>Food</b>	Gives us energy so that we can move, grow, and function. It also gives us nutrients to build and mend bones, teeth, nails, skin, hair, flesh, and organs.	
<b>Oxygen</b>	Helps us to obtain energy from sugars.	
<b>Water</b>	Allows nutrients to circulate through the body. Helps to regulate body temperature. The cells that make up our bodies are made mainly of water.	
<b>Moderate temperature</b> (Average global temperature above 0° C and below 50° C)	Allows us to maintain an average body temperature of 98.6° F/37°C and to maintain water in a liquid state at all times.	
<b>Protection from poisonous gases and high levels of radiation</b>	To prevent cancer, disease and damage to the body.	
<b>Gravity</b>	Allows our biological systems to develop and function normally. Holds the atmosphere on the Earth so it doesn't escape into space.	